University of Windsor

Dept. of Electrical & Computer Engineering

ELEC-2110: Computer Aided Analysis

(Fall 2020)

General Information

- **Class Hours:** Tue. & Thu. from 11:30 a.m. to 12:50 p.m. in Blackboard Virtual Classroom
- **Lab Hours:** Tue. from 8:30 a.m. to 10:20 a.m. in Blackboard Virtual Classroom
- **Tutorial Hours:** Thu. from 8:30 a.m. to 10:20 a.m. in Blackboard Virtual Classroom
- **Instructor:**

Name	E-mail	Office Hour (Location)
Dr. Balakumar Balasingam	singam@uwindsor.ca	Wed. 2-3 p.m.(Blackboard)

- **Graduate Assistant(s):**

Name	E-mail	Office Hour (Location)
Prarthana Pillai	pillaip@uwindsor.ca	Wed. 2-3 p.m.(Blackboard)

Course Objective

Introduction to numerical algorithms; fundamental to scientific computation; equation solving; function approximation; integration; difference and differential equations; special computer techniques; Emphasis is placed on efficient use of computers to optimize speed and accuracy in numerical computations; extensive digital computer usage for algorithm verification. Labs will introduce C++ to solve numerical problems.

Textbook

- Steven Chapra and Raymond Canale, *Numerical Methods for Engineers* 7^{th} *Edition,* McGraw-Hill Education, 2015.

Grading

	Percentage	**Details**
Quizzes	20 %	Several pop quizzes in class
Homeworks	20 %	Approximately two homework per month
Lab	20 %	8 labs
Exams	20 %	One midterm exam and a final exam
Project	20 %	One project that is due on the last day of class
Total	**100 %**	

Note: There will be several pop quizzes and the marks will be averaged. There won't be any makeup quizzes for those who miss one. However, one or two quizzes with the lowest marks will be excluded before averaging.

Course Outline

Lecture	Details
Lecture 01	Introduction
Lecture 02	Algorithms
Lecture 03	Error Analysis
Lecture 04	Taylor Series
Lecture 05–07	Roots of Equations
Lecture 08	Gaussian Elimination
Lecture 09	LU Decomposition
Lecture 10	Optimization Methods
Lecture 11	Simplex Method
Lecture 12	Curve Fitting
Lecture 13	Polynomial Interpolation
Lecture 14	Numerical Integration
Lecture 15	Numerical Differentiation
Lecture 16	Ordinary Differential Equations
Lecture 17	Partial Differential Equations

Lab Outline

Lab	Details
Lab 01	Introduction to programming
Lab 02	Algorithms
Lab 03	Taylor sereis
Lab 04	Root finding
Lab 05	Linear algebra
Lab 06	Optimization (the simplex method)
Lab 07	Curve fitting
Lab 08	Numerical differentiation & integration
Lab 09	Differential equations

Additional Information

This syllabus is only a short form. For detailed information please refer to the long-form syllabus that is available in blackboard.

Learning Outcomes

Number	Details	Evaluation Method
LO1	Understanding the concepts of algorithms	homework, quiz, & exams
LO2	Formulating engineering problems as algorithms	homework, quiz, & exams
LO3	Understanding the basics of C++ coding	Lab & project
LO4	Developing algorithms in C++	Lab & project

Canadian Engineering Accreditation Board (CEAB) Criteria

This course will develop the following CEAB Graduate Attributes Criteria via Learning Outcomes:

CEAB Graduate Attributes Criteria	Learning Outcome #
1. A knowledge base for engineering Demonstrated competence in University level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.	
2. Problem analysis. An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.	LO1-LO2
3. Investigation. An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data, and synthesis of information in order to reach valid conclusions.	LO1-LO2
4. Design. An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, economic, environmental, cultural and societal considerations.	LO1-LO2
5. Use of engineering tools. An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.	LO1-LO4

6. Individual and team work. An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.	LO4
7. Communication skills. An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.	LO4
8. Professionalism. An understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest.	
9. Impact of engineering on society and the environment. An ability to analyze societal and environmental aspects of engineering activities. Such ability includes an understanding of the interactions that engineering has with the economic, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interactions; and the concepts of sustainable design and development and environmental stewardship.	
10. Ethics and equity. An ability to apply professional ethics, accountability, and equity.	LO4
11. Economics and project management. An ability to appropriately incorporate economics and business practices including project, risk and change management into the practice of engineering and to understand their limitations.	
12. Life-long learning. An ability to identify and to address their own educational needs in a changing world in ways sufficient to maintain their competence and allow them to contribute to the advancement of knowledge.	LO4